

What is claimed is:

1. A method to fill a metal in fine grooves formed in a surface of a substrate, comprising:
bringing the substrate into contact with a plating solution;
plating the substrate with the plating solution electrically with an electric current to form a plated metal film;
stopping the electric current to interrupt the plating before the plated metal film reaches a desired film thickness;
etching the plated metal film electrolytically with a direct electric current opposite to the electric current during plating; and
plating the substrate having the etched metal film to form a remaining film thickness to reach the desired film thickness.
2. A method according to claim 1, wherein a current density of the direct electric current during etching in a range of 1 mA/cm² to 30 mA/cm².
3. A method according to claim 1, wherein the direct electric current for performing etching is supplied for a period of time in a range of about 0.5 seconds to 30 seconds.
4. A method according to claim 1, wherein said metal is copper.
5. A method according to claim 1, wherein the etching is performed with the plating solution.
6. A method according to claim 1, wherein the plating of the substrate having the etched metal film is performed with the plating solution.
7. A metal for plating a substrate with copper, comprising:
bringing, at least once, a substrate into contact with a processing liquid offering surface activity of a substrate surface and/or increasing wettability between a plating solution and

the substrate surface;

performing one of removing the processing liquid from the substrate and drying the substrate; and

bringing the substrate into contact with the plating solution to plate the substrate after performing one of removing the processing liquid from the substrate and drying the substrate.

8. A method according to claim 7, wherein said performing includes one of rotating the substrate to spin off the processing liquid from the substrate, rotating the substrate and applying a gas below to the substrate, and passing the substrate through a forced air.

9. A method according to claim 7, wherein said performing is successively performed after the substrate is brought into contact with the processing liquid by one apparatus.